

Claims

What is claimed is:

1. An internal combustion engine, comprising:
  - a cylinder block defining a cylinder;
  - a piston reciprocally disposed in said cylinder;
  - a connecting rod connected to said piston;
  - a crankshaft connected to said connecting rod;
  - a vcr mechanism connected to said crankshaft;
  - a first gear connected to said crankshaft;
  - a second gear in mesh with said first gear, said second gear being connected to said vcr mechanism; and
  - a third gear in mesh with said second gear, said third gear having a fixed center of rotation.
2. The internal combustion engine of claim 1 wherein:
  - said cylinder block has a top surface; and
  - said crankshaft has an axis, said crankshaft being moveable between a first crankshaft position at which said axis is a first defined distance from said top surface of said cylinder block and a second crankshaft position at which said axis is a second defined distance from said top surface of said cylinder block.
3. The internal combustion engine of claim 2 wherein:
  - said vcr mechanism is moveable between a first mechanism position at which said crankshaft is at said first crankshaft position and a second mechanism position at which said crankshaft is at said second crankshaft position; and

said second gear has an axis, said axis of said second gear being moveable between a first position at which said vcr mechanism is at said first mechanism position and a second position at which said vcr mechanism is at said second mechanism position.

4.     The internal combustion engine of claim 1 including a vcr connection device located to connect said vcr mechanism to said second gear.

5.     The internal combustion engine of claim 4 wherein said vcr connection device is an arm.

6.     The internal combustion engine of claim 4 wherein said vcr connection device is a carrier.

7.     The internal combustion engine of claim 1 wherein:  
        said first gear has a plurality of teeth;  
        said third gear has a plurality of teeth; and  
        said second gear has a plurality of teeth, at least one of said plurality of teeth of said second gear being in simultaneous contact with at least one of said plurality of teeth of said first gear and at least one of said plurality of teeth of said third gear.

8.     The internal combustion engine of claim 1 wherein:  
        said first gear has a plurality of external teeth,  
        said second gear has a plurality of external teeth, at least one of said plurality of teeth of said second gear being in contact with at least one of said plurality of teeth of said first gear, and

said third gear has a plurality of external teeth, at least one of said plurality of teeth of said third gear being in contact with at least one of said plurality of teeth of said second gear.

9.    The internal combustion engine of claim 1 wherein at least one of said first gear, said second gear, and said third gear has a plurality of internal teeth.

10.    The internal combustion engine of claim 9 wherein:  
        said first gear has a plurality of internal teeth,  
        said second gear has a plurality of external teeth, at least one of said plurality of teeth of said second gear being in contact with at least one of said plurality of teeth of said first gear, and  
        said third gear has a plurality of internal teeth, at least one of said plurality of teeth of said third gear being in contact with at least one of said plurality of teeth of said second gear.

11.    The internal combustion engine of claim 9 wherein:  
        said first gear has a plurality of external teeth;  
        said second gear has a plurality of internal teeth, at least one of said plurality of teeth of said second gear being in contact with at least one of said plurality of teeth of said first gear, and  
        said third gear has a plurality of external teeth, at least one of said plurality of teeth of said third gear being in contact with at least one of said plurality of teeth of said second gear.

12.    The internal combustion engine of claim 1 wherein said vcr mechanism includes a crankshaft cradle.

13. The internal combustion engine of claim 1 including a camshaft operatively connected to said third gear.

14. A gear train for an internal combustion engine, said internal combustion engine having a crankshaft and a vcr mechanism connected to said crankshaft, said gear train comprising:

a first gear connected to said crankshaft;

a second gear in mesh with said first gear, said second gear being connected to said vcr mechanism; and

a third gear in mesh with said second gear, said third gear having a fixed center of rotation.

15. The gear train of claim 14 wherein:

said first gear has an axis, said axis of said first gear being moveable between a first position and a second position; and

said second gear has an axis, said axis of said second gear being moveable between a first position at which said axis of said first gear is at said first position and a second position at which said axis of said first gear is at said second position.

16. The gear train of claim 14 wherein:

said first gear has a plurality of teeth;

said third gear has a plurality of teeth; and

said second gear has a plurality of teeth, at least one of said plurality of teeth of said second gear being in contact with at least one of said plurality of teeth of said first gear and at least one of said plurality of teeth of said third gear.

17. The gear train of claim 14 wherein:

said first gear has a plurality of external teeth,

    said second gear has a plurality of external teeth, at least one of said plurality of teeth of said second gear being in contact with at least one of said plurality of teeth of said first gear, and

    said third gear has a plurality of external teeth, at least one of said plurality of teeth of said third gear being in contact with at least one of said plurality of teeth of said second gear.

18.     The gear train of claim 14 wherein at least one of said first gear, said second gear, and said third gear has a plurality of internal teeth.

19.     The gear train of claim 18 wherein:

    said first gear has a plurality of internal teeth,

    said second gear has a plurality of external teeth, at least one of said plurality of teeth of said second gear being in contact with at least one of said plurality of teeth of said first gear, and

    said third gear has a plurality of internal teeth, at least one of said plurality of teeth of said third gear being in contact with at least one of said plurality of teeth of said second gear.

20.     The gear train of claim 18 wherein:

    said first gear has a plurality of external teeth;

    said second gear has a plurality of internal teeth, at least one of said plurality of teeth of said second gear being in contact with at least one of said plurality of teeth of said first gear, and

    said third gear has a plurality of external teeth, at least one of said plurality of teeth of said third gear being in contact with at least one of said plurality of teeth of said second gear.

21. A method of operating an internal combustion engine having a crankshaft, a gear train connected to said crankshaft, and a camshaft connected to said gear train, said crankshaft having an axis, said method comprising:

moving said axis of said crankshaft from a first position to a second position;

sustaining a driving relationship between said crankshaft and said gear train; and

maintaining a timing relationship between said crankshaft and said camshaft.

22. The method of claim 21 wherein said maintaining includes preventing secondary rotation of said crankshaft.

23. The method of claim 22 wherein said preventing is accomplished by a second gear acting upon said first gear.

24. The method of claim 23 including moving an axis of said second gear from a first position to a second position.

25. The method of claim 24 including meshing said second gear with a third gear, said third gear having a fixed center of rotation, said third gear being operatively connected to said camshaft.

26. An internal combustion engine, comprising:  
a cylinder block defining a cylinder;  
a piston reciprocally disposed in said cylinder;  
a connecting rod connected to said piston;

a crankshaft connected to said connecting rod, said crankshaft having an axis;

    a gear train connected to said crankshaft;

    a camshaft connected to said gear train;

    means for moving said axis of said crankshaft from a first position to a second position;

        means for sustaining a driving relationship between said crankshaft and said gear train; and

        means for maintaining a timing relationship between said crankshaft and said camshaft.